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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 35273PC01	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/DK2004/000487	International filing date *(day/month/year)* 07.07.2004	Priority date *(day/month/year)* 07.07.2003
International Patent Classification (IPC) or national classification and IPC C08B37/06, A23L1/0524, A24B15/00		
Applicant KMC KARTOFFELMELCENTRALEN AMBA et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 6 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (Indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
04.05.2005	11.11.2005
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Lensen, H Telephone No. +31 70 340-2428

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/DK2004/000487

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-41 as originally filed

Claims, Numbers

1-42 received on 03.10.2005 with letter of 03.10.2005

Drawings, Sheets

1/1 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-42
	No:	Claims	
Inventive step (IS)	Yes:	Claims	16-19, 29-42
	No:	Claims	1-15, 20-28
Industrial applicability (IA)	Yes:	Claims	1-42
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1). Reference is made to the following documents:

D4 : US-A-2754214
D7 : US-A-2444266
The document D7 was not cited in the international search report. A copy of the document is appended hereto.

2). Art. 33(2) PCT (Novelty) :
The subject-matter of claims appears to be novel since no document of the available prior art discloses the same method for providing fibre-containing pectin products as defined in claim 1.

3). Art. 33(3) PCT (Inventive step) :
The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-15 and 20-28 appears not involve an inventive step in the sense of Article 33(3) PCT.
The document D4 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses a process for providing a fibre-containing pectin product from a plant material wherein the de-esterification treatment step is performed at a pH-value from 5.80 to 7. Before the alkaline treatment, the peels are placed in a tank containing a salt such as sodium chloride at a concentration of about 0.25 mol per litre.
The subject-matter of claim 1 therefore differs from this known process in that the de-esterification step is an alkaline treatment at a pH value above 7.0.
The problem to be solved by the present invention may therefore be regarded as to provide a new and simple method of treating pectin-containing plants under de-esterifying conditions, thereby achieving fibre-containing products as well as isolated products having improved gel-forming and/or viscous giving properties.

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons.
D7 relates to pectic materials and to a process for preparing partially demethoxylated pectins (pectinic acids) of high molecular weight. The process comprises an aqueous slurry of citrus peel or apple pomace at a temperature within the range of 0° tp 60°C and sufficient sodium hydroxide to bring the reaction mixture to a pH of 6 to 10 and preferably from 8 to 10. Under these conditions, the pectin-esterase demethoxylates the pectin in situ. The resulting products are very fibrous in nature and their solutions exhibit very high viscosities.
The skilled person, confronted with problem, would easily combine the teaching of D4 and D7 and come to solution as defined in claim 1.

4). Dependent claims 2-15 and 20-28 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step. The temperature, the salt concentration, the de-esterification treatment time, the choice and the amount of the alkaline reagent are for the skilled person trivial and obvious technical features in view of D4 and D7.

5). The combination of the features of dependent claims 16-19 and 29-42 together with the features of the main claim 1 is neither known from, nor rendered obvious by, the available prior art.
The reasons are as follows : the skilled person finds no suggestion in the available prior art that by combining the enzymatic de-esterification treatment at a pH above 7 with a further amidation treatment, the fibre-containing product can form in aqueous solutions comprising calcium ions, stable gels with surprisingly high gel strength.
The subject-matter of the claims 16-19 and 29-42 is novel and involves an inventive step.

Application No: PCT/DK2004/000487
Publication No: WO 05/003178

AMENDED CLAIMS - OCTOBER 2005

1. A method for providing a fibre-containing pectin product from a plant material, said method comprising the steps of:

(i) providing an *in situ* reaction system by swelling the plant material in an aqueous solution, where said aqueous solution comprising at least one salt,

(ii) subjecting pectin present in the swollen plant material from step (i) to a de-esterification treatment, and

(iii) separating the de-esterified fibre-containing pectin product,

wherein the de-esterification treatment in step (ii) is an alkaline treatment having a pH-value above 7.0.

2. The method according to claim 1, wherein the aqueous solution does not contain an organic solvent.

3. The method according to any one of claims 1 or 2, wherein the plant material is swelled in the aqueous solution for 1 to 120 minutes.

4. The method according to any one of claims 1-3, wherein the plant material is swelled in the aqueous solution at a temperature in the range of 0-120°C.

5. The method according to any one of claims 1-4, wherein the plant material is swelled in the aqueous solution providing a dry matter content of the plant material in a range from 1-50%.

6. The method according to any one of claims 1-5, wherein the amount of the at least one salt correspond to a salt concentration from 1 mmol to 30 mmol per gram of plant material dry matter, such as from 5 mmol to 15 mmol.

7. The method according to any one of claims 1-6, wherein the aqueous solution is an inorganic aqueous solution.

8. The method according to any one of claims 1-7, wherein the at least one salt is a water-soluble and neutral salt.

9. The method according to claim 8, wherein the water-soluble and/or neutral salt is selected from the group consisting of sodium salts, potassium salts, calcium salts, chloride salts, nitrate salts and mixtures thereof.

10. The method according to any one of claims 1-9, wherein the de-esterification treatment is continued for 1 to 120 minutes.

11. The method according to any one of claims 1-10, wherein the de-esterification treatment is performed at a temperature in the range of 0-120°C.

12. The method according to any one of claims 1-11, wherein the de-esterification treatment is performed with a dry matter content of the plant material in a range from 1-50%.

13. The method according to claim 1, wherein alkaline condition provided in step (ii) is provided by the addition of a alkaline reagent giving a pH above 8, e.g. above 9, such as above 10, e.g. above 11, such as above 12, e.g. above 13, such as 14. (in the range from 7-14, such as in the range of 8-13, e.g. in the range of 9-13, such as in the range of 10-13, e.g. in the range of 11-13, such as in the range of 11.5-12.5)

14. The method according to claim 13, wherein the alkaline reagent is at least one of ammonia or other low molecular amines, diamines or amino acids, hydroxides of sodium, potassium and calcium or hydroxides of organic bases, such as tetramethylammonium-hydroxide.

15. The method according to claim 14, wherein the amount of alkaline reagent is from 20 mmol to 80 mmol of basic reagent per gram of pectin-containing plant dry matter.

16. The method according to any one of claims 1-15, wherein the plant material is further subjected to an amidation treatment.

17. The method according to claim 16, wherein the amidation is provided by addition of an amidation reagent selected from the group consisting of ammonia or other low molecular amines, diamines or amino acids.

18. The method according to any one of claims 16 or 17, wherein the swollen plant material obtained in step (i) is treated with the amidation reagent for 1 to 120 minutes.

19. The method according to any one of claims 16-18, wherein the swollen plant material obtained in step (i) is treated with the amidation reagent at a temperature in the range of -15 to 75°C.

20. The method according to any one of claims 1-19, wherein the separated and de-esterified fibre-containing product obtained in step (iii) is subjected to at least one washing step and/or at least one pressing step to obtain the fibre-containing pectin product.

21. The method according to claim 20 wherein the washed and/or dried fibre-containing pectin product is dried to a dry matter content of at least 90% by weight,. and optionally comminuted.

22. The method according to any one of claims 1 or 21, wherein the fibre-containing pectin product has a degree of esterification from 0-80, such as from 0-50, e.g. from 2-50, such as from 2-45, e.g. from 2-40, such as from 5-50, e.g. from 10-50, such as from 10-40, e.g. from 15-35.

23. The method according to any one of claims 1-22, wherein the fibre-containing pectin product has a degree of amidation of not more that 95% e.g. not more than 75%, such as not more than 60%, not more than 50%, such as not more than 40%, e.g. not more than 30%, such as not more than 25%, e.g. not more than 20%.

24. The method according to any one of claims 1-23, wherein the fibre-containing pectin product obtained in step (iii) has a dry matter content of at least 1% (w/w) of the dry matter, such as at least 5% (w/w) of the dry matter, e.g. at least 10% (w/w) of the dry matter, such as at least 15% (w/w) of the dry matter, e.g. at least 25% (w/w) of the dry matter, such as at least 50% (w/w) of the dry matter, e.g. at least 75% (w/w) of the dry matter, such as at least 85% (w/w) of the dry matter, e.g. at least 95% (w/w) of the dry matter..

25. The method according to any one of claims 1-24, wherein the plant material is obtained from a native vegetable material in a fresh or dried state.

26. The method according to any one of claims 1-25, wherein the plant material is selected from the group consisting of potato pulp, sugar beet pulp, pomace residues from apples, peels or pulp from citrus fruits, such as lemon, orange, mandarin, lime, and grapefruit.

27. A fibre-containing pectin product obtainable by a method according to any one of claims 1-26.

28. The product according to claim 27, wherein the fibre content present in the product is at least 1% (w/w) of the dry matter, such as at least 5% (w/w) of the dry matter, e.g. at least 10% (w/w) of the dry matter, such as at least 15% (w/w) of the dry matter, e.g. at least 25% (w/w) of the dry matter, such as at least 50% (w/w) of the dry matter, e.g. at least 75% (w/w) of the dry matter, such as at least 85% (w/w) of the dry matter, e.g. at least 95% (w/w) of the dry matter.

29. A method for providing a pectin product, said method comprising the steps of:

(i) providing a fibre-containing pectin product according to any one of claims 27 or 28,

(ii) adding an extraction medium to the fibre-containing pectin product providing an extraction suspension,

(iii) adjusting the pH of the extraction suspension to a pH in the range of 1-12,

(iv) adjusting the temperature of the extraction suspension to a temperature in the range of 0-120°C, and

(v) isolating the pectin product from the aqueous phase of the extracting medium.

30. The method according to claim 29, wherein the extraction medium has a pH in the range of 1-6, such as in the range of 2-6, e.g. in the range of 2-5, such as in the range of 3-5, e.g. in the range of 4-5.

31. The method according to any one of claims 29 or 30, wherein the temperature is in the range of 40-100°C, such as in the range of 60-80°C.

32. The method according to any one of claims 29-31, wherein the pectin product is isolated by any known method such as precipitation, extraction, centrifugation, filtration, chromatography, drying.

33. A pectin product obtainable by a method according to any one of claims 29-32.

34. The product according to claim 33, wherein said product fulfils at least one of following requirements:

(i) the product has a viscosity of at least 40 cp when mixed in a concentration of at the most 1% (w/w) of pectin in a solution and measured by using a citric/citrate buffer and in a Haake Rheostress 1 viscosimeter as defined in method A, or

(ii) the product has a viscosity which is at least 2 times higher than the viscosity of conventional manufactured pectin products when mixed in a concentration of at the most 1% (w/w) of pectin in a solution and measured by using a citric/citrate buffer and in a Haake Rheostress 1 viscosimeter as defined in method A.

35. A product comprising pectin that fulfils at least one of following requirements:

(i) the product has a viscosity of at least 40 cp when mixed in a concentration of at the most 1% (w/w) of pectin in a solution and measured by using a citric/citrate buffer and in a Haake Rheostress 1 viscosimeter as defined in method A, or

(ii) the product has a viscosity which is at least 2 times higher than the viscosity of conventional manufactured pectin products when mixed in a concentration of at the most 1% (w/w) of pectin in a solution and measured by using a citric/citrate buffer and in a Haake Rheostress 1 viscosimeter as defined in method A.

36. The product according to claim 35, wherein the product has a viscosity of at least 30 cp when mixed in a concentration of at the most 1% (w/w) of pectin in a solution, such as at least 10 cp, e.g. at least 15 cp, such as at least 20 cp, e.g. at least 25 cp, such as at least 35 cp, e.g. at least 40 cp, such as at least 45 cp, e.g. at least 50 cp, such as at least 75 cp, e.g. at least 100 cp, such as at least 150 cp, e.g. at least 200 cp.

37. The product according to any one of claims 35 or 36 wherein the product has a viscosity which is at least 2.5 times higher than conventional used pectin products, such as at least 3 times higher, e.g. at least 3.5 times higher, such as at least 4 times higher, e.g. at least 5 times higher.

38. The product according to any one of claims 35-37, wherein the pectin has a degree of esterification from 0-80, such as from 0-50, e.g. from 2-50, such as from 2-45, e.g. from 2-40, such as from 5-50, e.g. from 10-50 and/or a degree of amidation of not more that 95% e.g. not more than 75%, such as not more than 60%, not more than 50%, such as

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not more than 40%, e.g. not more than 30%, such as not more than 25%, e.g. not more than 20%.

39. Use of a product according to any one of claims 27-28, 33-34 or 35-38 for the encapsulation of, e.g., easily volatile lipid and/or water-soluble aromatic and colouring agents or by encapsulating micronutrients, flavouring agents, vitamins, etc.

40. Use of a product according to any one of claims 27-28, 33-34 or 35-38 in the production of solid and liquid pharmaceutical compositions, including, e.g., tablets, suspensions, emulsions, etc. and as components in cosmetic products, such as perfumes, creams, and lotions, etc

41. Use of a product according to any one of claims 27-28, 33-34 or 35-38 as a viscosifying agent and/or an emulsifying agent

42. Use of a product according to any one of claims 27-28, 33-34 or 35-38 for fat replacement or for the replacement of tobacco.